

### Reference Tables for

### EARTH/ ENVIRONMENTAL SCIENCE

Selected equations, formulas, physical data to be used as a reference for instruction and classroom assessment.

### March 2003

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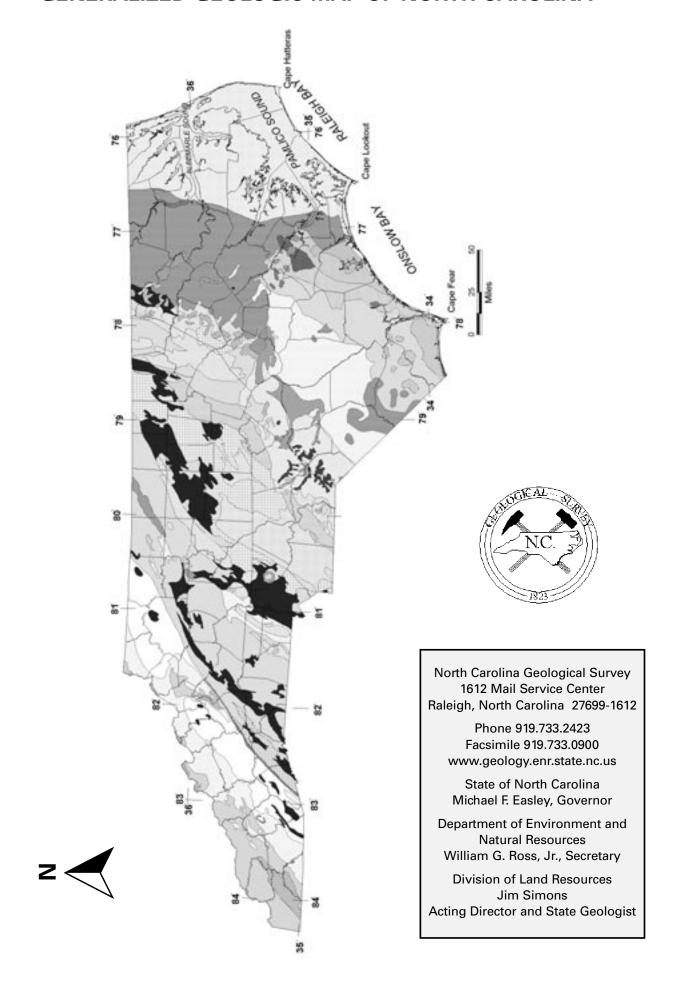
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### **GENERALIZED GEOLOGIC MAP OF NORTH CAROLINA**

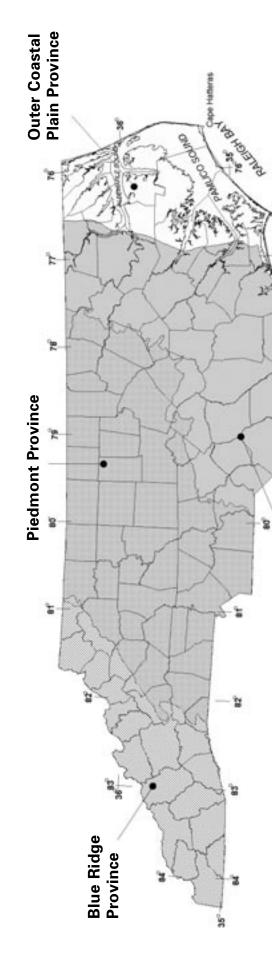


### **Sedimentary Rocks** Sedimentary and Metamorphic Rocks Sedimentary rocks - sandstone, dolomite, shale and siltstone. Surficial deposits, undivided - sand, clay and gravel, (Shown only below 25 feet of elevation.) Metasedimentary and metavolcanic rocks of the Kings Mountain belt - schist, phyllite, marble, metavolcanic rock, Pinehurst Formation - unconsolidated sand. quartzite and gneiss. Terrace deposits and upland sediment - gravel, clayey sand Metamorphic rocks of the Inner Piedmont, Milton belt and Raleigh belt – gneiss, schist and amphibolite. Waccamaw Formation - fossiliferous sand with silt and clay. Metavolcanic rocks of the Carolina slate belt and eastern slate Yorktown Formation and Duplin Formation, undivided belt-felsic metavolcanic rock with mafic and intermediate Yorktown Formation - fossiliferous clay and sand. volcanic rock. Duplin Formation - shelly sand, sandy mud and limestone. Metasedimentary rocks of the Carolina slate belt and eastern Belgrade Formation, undivided - Pollocksville Member - oysterslate belt - metamudstone, argillite and epiciastic rock. shell mounds in sand matrix. Haywood Landing Member fossiliferous clayey sand. Clastic and carbonate metasedimentary rocks of the murphy River Bend Formation - sandy, molluscan-mold limestone. belt - schist, phyllite, quartzite, marble, slate and metasiltsonte. Brevard fault zone - schist, marble and phyllonite. Castle Hayne Formation -Clastic metasedimentary and metavolcanic rocks of the Ocoee Spring Garden Member - molluscan-mold limestone. Supergroup, Grandfather Mountain Formation. Mount Comfort Member and New Hanover Member, undivided -Rogers Formation and quanzite and felsic metavolcanic rock. Comfort Member - limestone with bryozoan and echinoid Clastic metasedimentary rock and mafic and felsic metavolcanic rock of the Ashe Metamorphic Suite, Tallulah Falls Formation New Hanover Member – phosphate-pebble congiomerate. and Alligator Back Formation - gneiss, schist, Beaufort Formation, undivided metagraywacke, amphibolite and calc-silicate granofels. Unnamed upper member - glanconitic, fossiliferous sand Felsic gneiss derived from sedimentary and igneous rocks in and siltyclay. the northern outcrop area: biotite gneiss in the southern Jericho Run Member - siliceous mudstone with sandstone lenses. outcrop area; locally mignatitic and mylonitic. Locally and variably interlayered with amphibolite, calc-silicate Peedee Formation - marine sand, clayey sand and clay. granofels and rare marble. Intruded by Late Proterozoic Black Creek Formation - lignitic sand and clay. mafic and felsic plutons. Middenforf Formation - sand, sandstone and clay. Cape Fear Formation – sandstone and sandy mudstone. **Intrusive Rocks** Dan River Group, undivided – Stoneville Formation – Granitic rocks - unfoliated to weakly foliated. conglomerate, sandstone and mudstone. Cow Branch Syenite - Concord ring dike. Formation - mudstone. Metamorphosed gabbro and diorite - foliated to weakly foliated. Pine Hall Formation – sandstone, mudstone and conglomerate. Metamorphosed granitic rocks - foliated to weakly foliated: Chatham Group, undivided - Sanford Formation - conglomerate, locally migmantic. sandstone and mudstone. Henderson Gneiss - uneven-grained monzonitic to granodioritic. Cumnock Formation - sandstone and mudstone. Meta-ultramafic rocks.

2003

Pekin Formation - conglomerate, sandstone and mudstone.

# PHYSLOGRAPHIC PROVINCES



### **Physlographic Provinces**

Inner Coastal Plain Province

Cape Lookout

The Blue Ridge Province is a mountainous area of steep ridges, inter-mountain basins and valleys that intersect at all angles, giving the area its rugged character. The Blue Ridge contains the highest mountains in eastern North America. About 125 peaks exceed 5,000 feet in elevation. The steep slope that separates the mountains and Piedmont is the Blue Ridge escarpment. Headward erosion of the Blue Ridge Mountains by Atlantic-flowing streams produces this sharp topographic break.

The Piedmont Province consists of generally rolling, well-rounded hills and ridges with a few hundred feet of elevation difference between the hills and valleys. Elevations in the Piedmont range from 300 to 600 feet above sea level near its border with the Coastal Plain to 1,500 feet at the foot of the Blue Ridge. Resistant knobs and hills, called monadnocks, which occur in the Piedmont Province, include the Sauratown, South and Uwharrie Mountains.

The Inner Coastal Plain Province consists of stair-step-like planar terraces that dip gently towards the ocean. At higher elevations, the land is dissected to form gently

rolling hills and valleys. Elevations range from about 600 feet to 25 feet above mean sea level. The boundary between the Piedmont and Coastal Plain to the Fall Zone. This zone represents the elevational break between the resistant rocks of the Piedmont and the more easily eroded sediments of the Coastal Plain.

The Outer Coastal Plain Province is characterized by flat, poorly drained land lying below 25 feet above mean sea level. The boundary between the Outer and Inner Coastal Plain is the Suffolk scarp. This feature is an ancient shoreline formed during a high stand of sea level. The scarp was cut by shoreline erosion during the late Pleistocene Epoch, more than 10,000 years ago.

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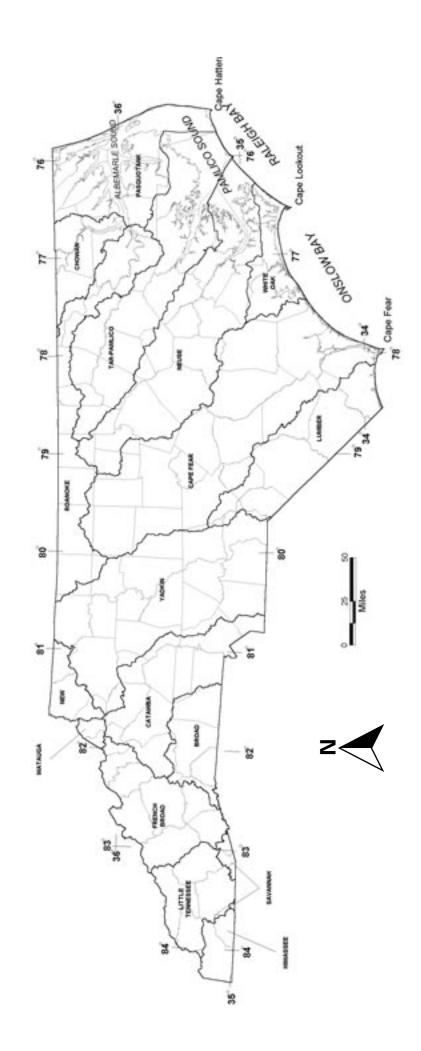
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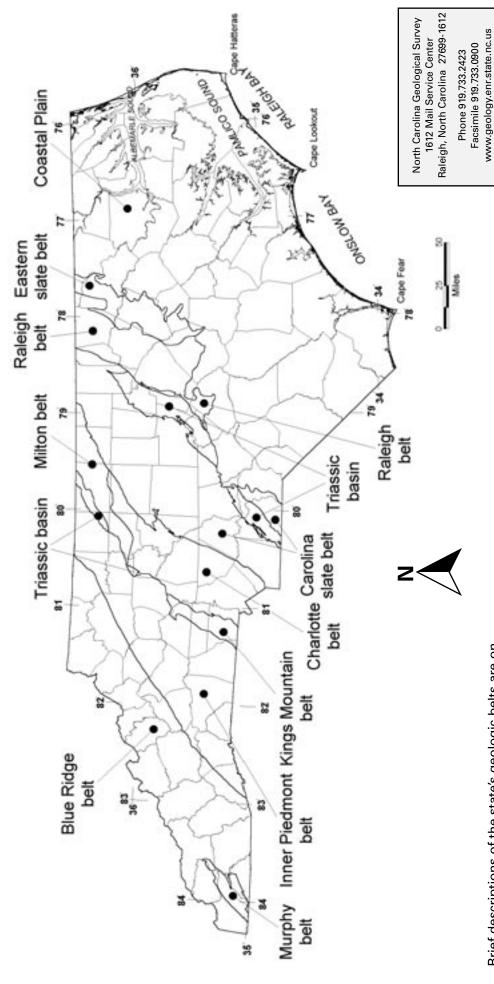
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Modified from 1991 Generalized Geologic Map, reprinted 1996 Digital representation by M. A. Medina and R. H. Carpenter



# **GEOLOGIC BELTS OF NORTH CAROLINA**



the following page. For additional information about Brief descriptions of the state's geologic belts are on geology, mineral resources, geologic hazards, earth science education, and topographic maps visit the North Carolina Geological Survey website at www.geology.enr.state.nc.us or by mail at:

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Digital representation by J.C. Reid, M. A. Medina and R. H. Carpenter Modified from 1991 Generalized Geologic Map, reprinted 1996

Jim Simons Acting Director and State Geologist

Division of Land Resources

Department of Environment and William G. Ross, Jr., Secretary

Natural Resources

State of North Carolina Michael F. Easley, Governor

### Blue Ridge belt

This mountainous region is composed of rocks from over about 500 million to over one billion years old. This complex mixture of igneous, sedimentary and metamorphic rock has repeatedly been squeezed, fractured, faulted and twisted into folds. The Blue Ridge belt is well known for its deposits of feldspar, mica and quartz – basic materials used in the ceramic, paint and electronic industries. Olivine is mined for use as refractory material and foundry molding sand. Dimension stone is also quarried for building construction and monuments.

### Murphy belt

This belt contains rocks that were originally sediments deposited in a warm, shallow sea over 500 million years ago. Later, these sediments were changed into metamorphic rocks including marble, which was used for building and road construction.

### **Inner Piedmont belt**

The Inner Piedmont belt is the most intensely deformed and metamorphosed segment of the Piedmont. The metamorphic rocks range from 500-750 million years old. They include gneiss and schist that have been intruded by younger granitic rocks. The northeast-trending Brevard fault zone forms much of the boundary between the Blue Ridge and Inner Piedmont belts. Although this zone of strongly deformed rocks is one of the major structural features in the southern Appalachians, its origin is poorly understood. Crushed stone for road aggregate and building construction is the principal commodity produced.

### Kings Mountain belt

This belt consists of moderately deformed and metamorphosed volcanic and sedimentary rocks. The rocks are about 400-500 million years old. Lithium deposits were once mined here. Now imported lithium ore is processed here to provide raw materials for chemical compounds, ceramics, glass, greases, batteries and TV glass.

### Milton belt

This belt consist of gneiss, schist and metamorphosed intrusive rocks. The principal mineral resource is crushed stone for road aggregate and for building construction.

### Charlotte belt

This belt consists mostly of igneous rocks such as granite, diorite and gabbro. These are 300-500 million years old. The igneous rocks are good sources for crushed and dimension stone for road aggregate and buildings.

### Carolina slate belt

This belt consists of slightly metamorphosed volcanic and sedimentary rocks. It was the site of a series of oceanic volcanic islands about 550-650 million years ago. This belt is known for its numerous abandoned gold mines and prospects.

North Carolina led the nation in gold production before the California Gold Rush of 1849. In recent decades, mining companies have prospected for gold in the area. Interest in recreational gold panning remains high. Mineral production includes crushed stone for road aggregate and pyrophyllite for refractories, ceramics, filler, paint and insecticide carriers.

### **Triassic basins**

The basins are filled with sedimentary rocks that formed about 190-240 million years ago. Streams carried mud, silt, sand and gravel from adjacent highlands into rift valleys similar to those of east Africa today. The mudstones are mined and processed to make brick, sewer pipe, structural tile and drain tile.

### Raleigh belt

The Raleigh belt contains granite, gneiss and schist. In the 19th century, there were a number of small building stone quarries in the region, but today the main mineral product is crushed stone for construction and road aggregate.

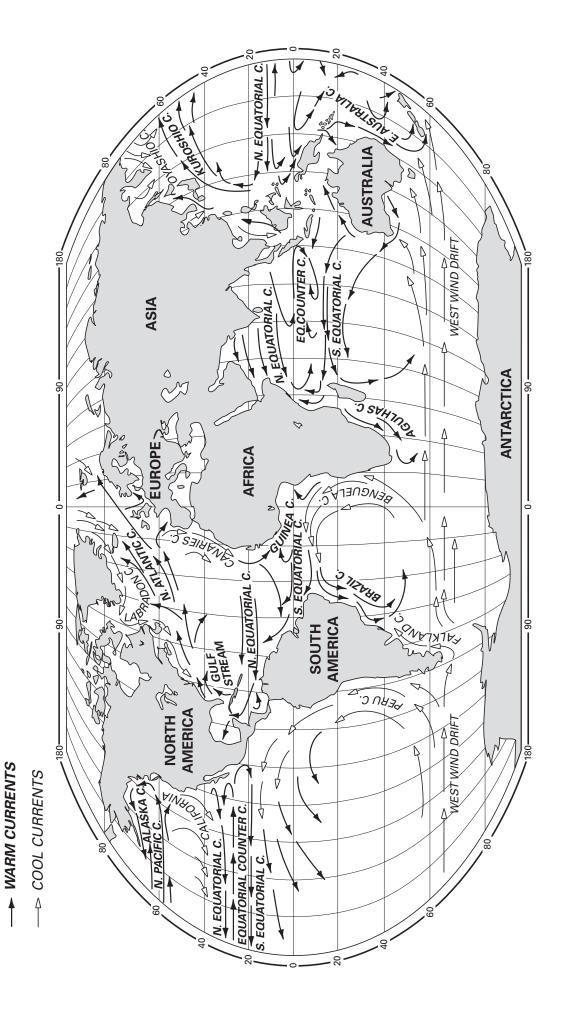
### **Eastern slate belt**

This belt contains slightly metamorphosed volcanic and sedimentary rocks similar to those of the Carolina slate belt. The rocks are poorly exposed and partially covered by Coastal Plain sediments. The metamorphic rocks, 500-600 million years old, are intruded by younger, approximately 300 million-year-old, granitic bodies. Gold was once mined in the belt, and small occurrences of molybdenite, a molybdenum ore, have been prospected here. Crushed stone is currently mined in this belt.

### **Coastal Plain**

The Coastal Plain is a wedge of mostly marine sedimentary rocks that gradually thickens to the east. The Coastal Plain is the largest geologic belt in the state. The most common sediment types are sand and clay, although a significant amount of limestone occurs in the southern part of the Coastal Plain. One of the largest deposits of phosphate in the world, an important fertilizer component, is mined in Beaufort County. Industrial sand is mined in the Sand Hills area. The sand is used to make container and flat glass, and ferrosilicon (used for filtration and sandblasting).

# **SURFACE OCEAN CURRENTS**



### MINERALS WITH NON-METALLIC LUSTER

HARDNESS TEST	MINERAL HARDNESS	MINERAL COLOR	STREAK COLOR	OTHER PROPERTIES USES	MINERAL NAME & COMPOSITION
Streak Plate (7.0)	6.5-7.5	Yellowish-green, dark red to black	None (harder than streak plate)	Used for jewelry and abrasives Crystals may be visible	GARNET Complex silicate
	7	Clear, milky, purple, rose	None (harder than streak plate)	Crystal faces common; concholdal fracture Glass, jewelry, and electronics	OUARTZ SiO <sub>2</sub> Silicon dioxide
	6.5-7	Green, black, or yellow	None (harder than streak plate)	Crystals with slightly conchoidal fracture Jewelry, ore of magnesium metal	OLIVINE Ferromagneisan silicate
Streak Plate (7.0)	6-6.5	White to pink	White	2 cleavages at 90° Ceramics and glass	POTASSIUM FELDSPAR (Orthoclase) Potassium aluminum silicate
	6-6.5	White to dark gray	White	2 cleavages at near 90°; some crystal faces may show striations Ceramics and glass	PLAGIOCLASE FELDSPAR Calcium-sodium aluminum silicate
	6	Dark green to black or brown	White to pale green	2 cleavages at 60° and 120°, May be splintery or fibrous, thin crystals Automotive brakes, tiles	AMPHIBOLE (Hornblende) calcium ferromagneisan aluminum silicate
	6	Dark green to black	White to pale green	2 cleavages at near 90°, blocky No commercial application	PYROXENE (Augite) calcium ferromagneisan silicate
Fingernail (2.2)	2	Clear may be yellow	White	Glassy transparent plates or satin-white rods Plaster of Paris, wall board (sheet rock)	GYPSUM CaSO <sub>4</sub> • 2H <sub>2</sub> Calcium sulfate
	1-1.5	Silvery, white or greenish white	White	Massive or foliated, Greasy or soapy feel, Talcum powder, paint – additive and soapstone	TALC Mg <sub>3</sub> Si <sub>4</sub> O <sub>10</sub> (OH) <sub>2</sub> Hydrous magnesian silicate
Glass plate, steel nail (6.0)	5.5-6.5	Red to dark gray, may be silvery gray flakes	Reddish Brown	Earthy appearance Ore of iron, pigment in paint and cosmetics. S.G, 4.9-5.3	HEMATITE Fe <sub>2</sub> O <sub>3</sub> Iron Oxide
	5.5-6.5	Black	Black	Magnetic; crystal Faces rare; S.G., 5.2 Ore of Iron	MAGNETITE Fe <sub>3</sub> O <sub>4</sub> Iron Oxide
Glass plate (5.5)	5-5.5	Brownish yellow, Ocher-yellow	Yellow brown	Earthy appearance; S.G., 4.0-4.4 Ore of Iron	LIMONITE Fe <sub>2</sub> O <sub>3</sub> nH <sub>2</sub> O Hydrous iron oxide

HARDNESS TEST	MINERAL HARDNESS	MINERAL COLOR	STREAK COLOR	OTHER PROPERTIES USES	MINERAL NAME & COMPOSITION
Steel nail (5.0)	3.5-4	Clear, yellow, gray, pink	White	Glassy; rhombic crystals and cleavage; some crystals curved; fizzes in hydrochloric acid when in powdered form Source of magnesium	DOLOMITE CaMg(CO <sub>3</sub> ) <sub>2</sub> Magnesian calcium carbonate
Copper penny (3.2)	3	Clear, yellow, white	White	Glassy; rhombic cleavage; fizzes in hydrochloric acid Cement, antacid tablets, fertilizer	CALCITE CaCo <sub>3</sub> Calcium carbonate
	2.5-3	Brown to black	Black	One perfect cleavage, flexible in thin sheets Electrical insulator	BIOTITE Feromagnesian potassium, hydrous aluminum silicate
	2-3	Clear to yellow	White	One perfect cleavage, transparent in this sheets Electrical insulator, computer chips	MUSCOVITE Potassium hydrous aluminum silicate
	2.5	Clear to dark gray	White	Glassy; cubic crystals; 3 cleavages at 90° produce cubic fragments; salty taste Table salt, water softners & ice melting	HALITE NaCl Sodium chloride
	1.5-2.5	Yellow to red	Pale yellow	Yellow to red, crystals or earthy appearance, no cleavage or may show conchoidal fracture; SG 2.1 Sulfuric acid, explosives, drugs, & fertilizers	SULFUR S Sulfur

### **MINERALS WITH METALLIC LUSTER**

HARDNESS TEST	MINERAL HARDNESS	MINERAL COLOR	STREAK COLOR	OTHER PROPERTIES USES	MINERAL NAME & COMPOSITION		
Steak Plate (7.0)	6-6.5	Brass yellow tarnishes to brown	Greenish black, dark gray	Cubic scrystals common; uneven fracture; SG 5.0 Ore of Sulfur	PYRITE (Fool's Gold) FeS <sub>2</sub>		
	5.5-6.5	Dark gray to black	Black	Magnetic; crystal faces rare; SG 5.1; some rust Ore of Iron	MAGNETITE Fe <sub>3</sub> O <sub>4</sub>		
Glass Plate (5.5)	5-5.5	Yellow-brown to brown	Yellowish brown	Amorphous; yellowish rust very common SG 3.6-4.4 Paint pigment	LIMONITE Fe <sub>2</sub> O <sub>3</sub> • H <sub>2</sub> O		
Copper penny (3.2)	2.5	Silver gray tarnishes to gray	Gray	Cubic crystals; 3 cleavages produce cubic fragments; SG 7.4 Ore of Lead	GALENA PbS		
Fingernail (2.2)	1	Pencil-lead gray	Dark gray to black	Finely crystalline; cleavage indicated by luster; feels greasy; SG 2.3 Pencil lead, lubricants	GRAPHITE C (carbon)		

### **CLASSIFICATION OF SEDIMENTARY ROCKS**

	PARTICAL SIZE		PHYSICAL PROPERTIES	ROCK NAMES				
	Coarse (>2mm) pebbles	Ab	oraded (rounded) pebbles; looks like concrete	CONGLOMERATE				
	and cobbles	An	igular fragments show no signs of abrasion	BRECCIA				
CLASTIC	Medium (0.06-2mm) sand	SANDSTONE	Mostly quartz, granular felspar; dark colored fragments of clay	QUARTZ SANDSTONE				
CL/	Fine (0.004-0.6mm) silt	Gri	tty; grains just visible	SILTSTONE				
	Very fine (<0.004mm) grains	l	nooth to very slightly gritty; grains not visible; compact its easily	SHALE				
	COMPOSITION		PHYSICAL PROPERTIES	ROCK NAMES				
	Calcite shell fragments	IES	Shells, shell fragments; packed and well cemented with calcite	FOSSIL LIMESTONE				
ဍ		5	Shells, shell fragments; poorly cemented with calcite	COQUINA				
ORGANIC		LIMESTONES	Shells vot visible to the unaided eye; chalky or powdery; white to light gray color	CHALK				
0	Plant material	Bla	ck to brown; typically may include plant fragments	COAL / BITUMINOUS				
	MINERALS		PHYSICAL PROPERTIES	ROCK NAMES				
	Halite	EVAPORATES	Cubic srystals and cubic cleavage; hardness 2.5; salty taste	ROCK SALT				
ASTIC	Gypsum	EVAPO	Soft (hardness 2); very fine crystals; usually white or pink	ROCK GYPSUM				
NON-CLASTIC	Dolomite	Tex	cture ranges from that of mudstone to that of travertine	DOLOSTONE				
2	Quartz		remely finely crystalline quartz (hardness 7); conchoidal cture, very sharp edges	CHERT				

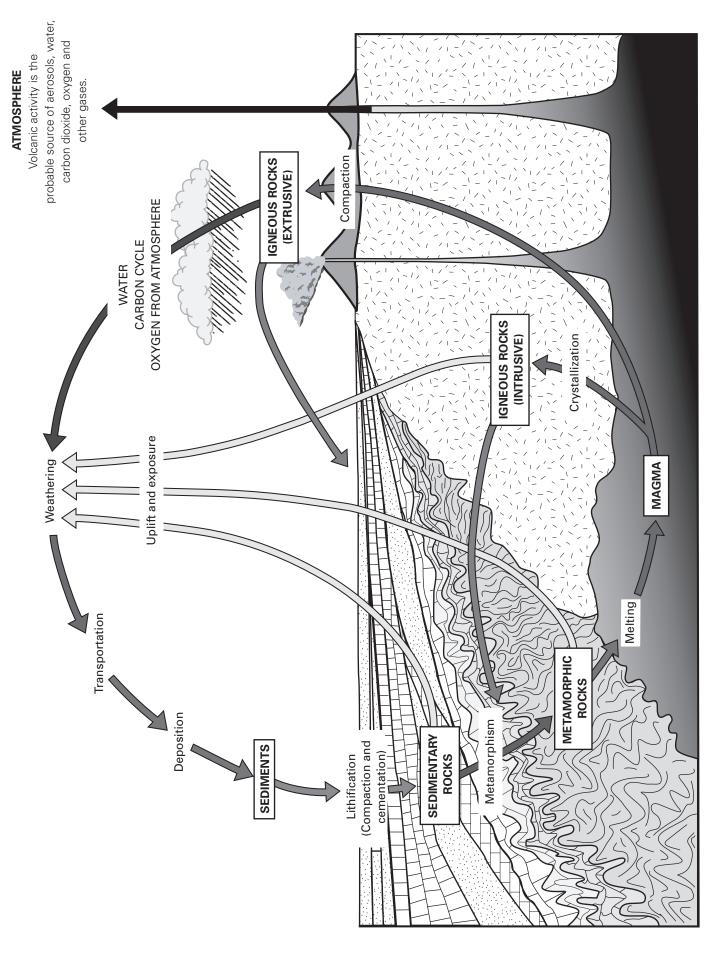
### **CLASSIFICATION OF METAMORPHIC ROCKS**

TE	XTURE	GRAIN SIZE	C	OM	PC	SI	TIC	N		TYPE OF METAMORPHISM			COMMENTS	ROCK NAMES
	ENT	Fine							Regio	nal			Low-grade metamorphism of shale	SLATE
G:	MINERAL ALIGNMENT	Fine to medium			(Heat and presure increase				Folation surfaces shiny from microscopic mia crystals	PHYLLITE				
FOLIATED	MINERA									With	depth)		Platy mica crystals visible from metamorphism of clay or feldspars	SCHIST
	BANDING	Medium to coarse	MICA QUARTZ FELDSPAR AMPHIBOLE GARNET					High-grade metamorphism; some mica changed to feldspar; segregated by mineral type into bands	GNEISS					
	Q	Fine	Variable				Contact (Heat)				Various rocks changed by heat from nearby magma/lava	HORNFELS		
	OLIATE	Fine to coarse	Qı	uartz	<u>'</u>					Reg	ional		Metamorphism of quartz sandstone	QUARTZITE
	NONFOLIATED		ı	lcite		d/o	r		Contact			Metamorphism of limestone or dolostone	MARBLE	
		Coarse		riou rticl							Pebbles may e distorted or stretched	METACONGLOMERATE		

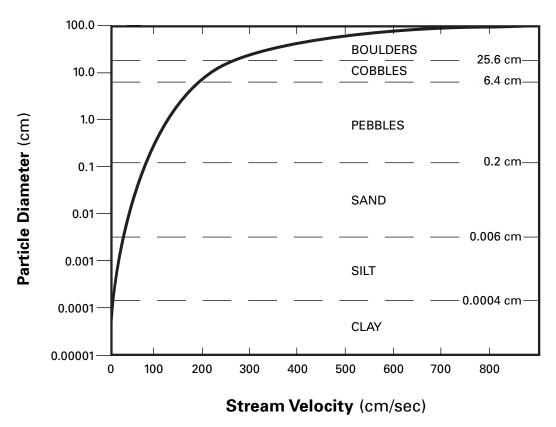
### **CLASSIFICATION OF IGNEOUS ROCKS**

							GRAIN SIZE	TEXTURE
		Granite	Diorite	Gabbro	Peridotite	Dunite	1mm or 10 mm	Coarse
ENVIRONMENT OF FORMATION	INTRUSIVE (Plutonic)	Pegmatite					10 mm or larger	Very Coarse
INT OF FC		Rhyolite	Andesite	Scoria/ Vescular Basalt	Rare	Rare	less than 1mm	Fine
VIRONIME		Pumice		Basaltic Glass	Rare	Rare	Non- crystalline	Glassy
NE NE	EXTRUSIVE (Volcanic)	Obsidian (Obsidian may ap)	pear black)	Balsaltic Glass	Rare	Rare		
<b>S</b>						 		
N Y	LIGHT	<b>~</b>	+	COLOR		<b>-</b>	DARK	
5	LOW	<b>~</b>	+	DENSITY		<b>-</b>	HIGH	
7	FELSIC (AI)	<b>~</b>		+ COMPOSITION		<b>-</b>	MAFIC (Fell	/lg)
, HAR	relaic (Ai)							
CHAR	100%—				 		— 100%	
		Potassium feldspar (pink to white)					100%	
	100%—	Potassium feldspar (pink to white)	:::::::::::::::::::::::::::::::::::::::	lagioclase feldspar (white to grey)	Pyroxene (green)		— 100% — 75%	
	100%—	Potassium feldspar (pink to white) Quan (clear to	tz white).	lagioclase feldspar	Pyroxene (green)			
MINERAL COMPOSITION CHARACTERISTICS	100%— (9 75%—		:::::::::::::::::::::::::::::::::::::::	lagioclase feldspar	Pyroxene (green)  Olivin (green		— 75%	

### THE ROCK CYCLE



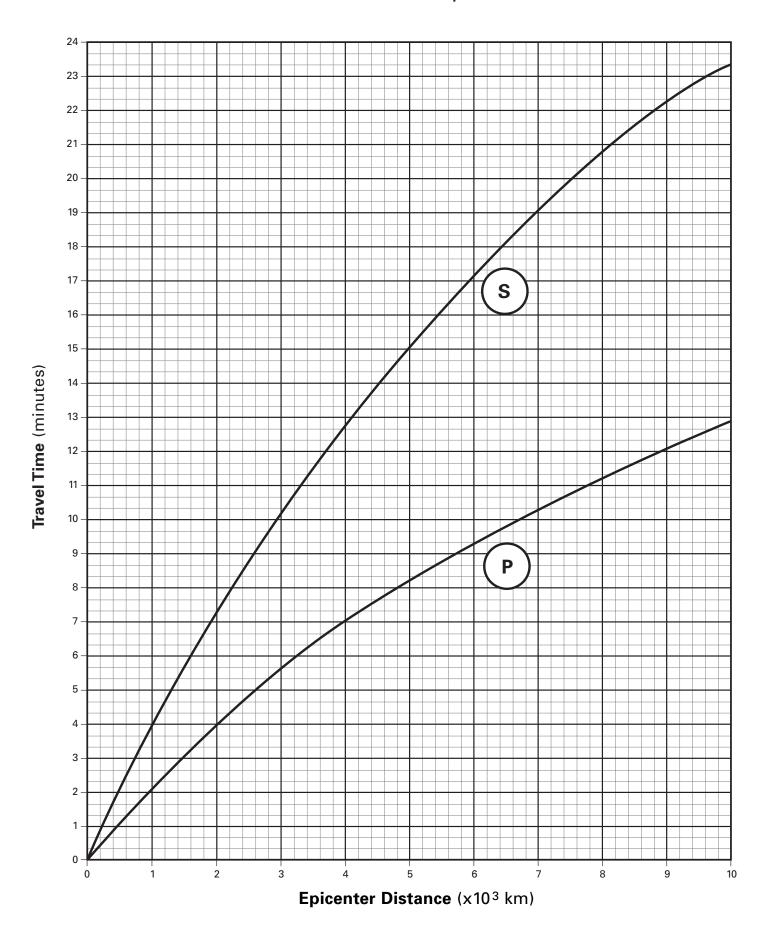
### **RELATIONSHIP OF TRANSPORTED PARTICLE SIZE TO WATER VELOCITY\***

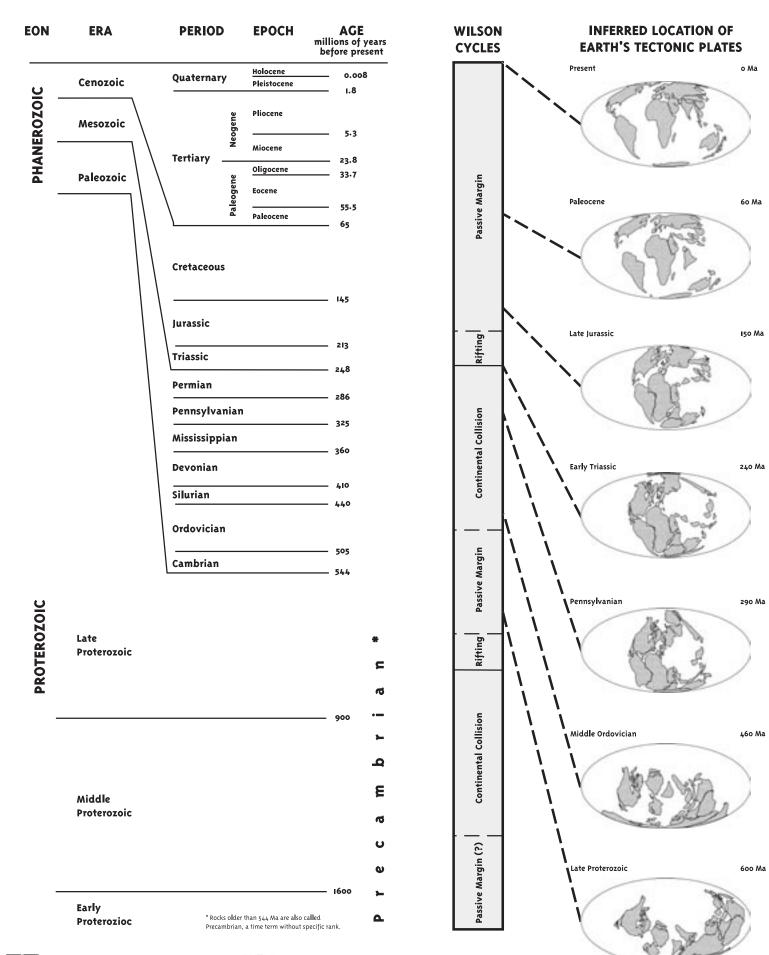


<sup>\*</sup>This generalized graph shows the water velocity needed to maintain, but not start movement. Variations occur due to differences in particle density and shape.

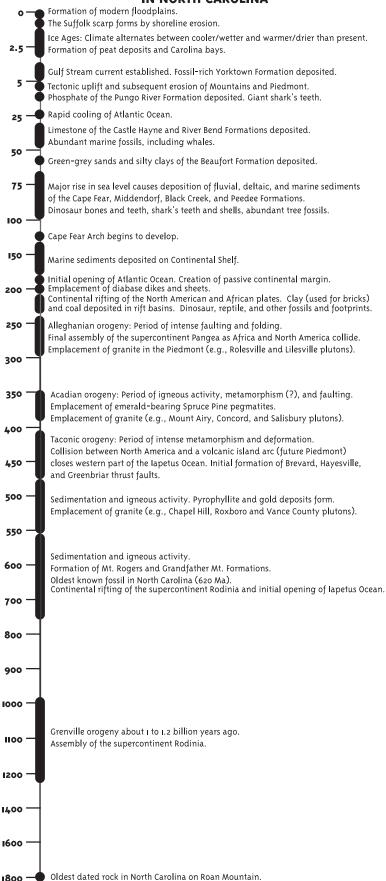
### **EARTHQUAKE S-WAVE & P-WAVE TIME TRAVEL GRAPH**

(at Normal Depth)

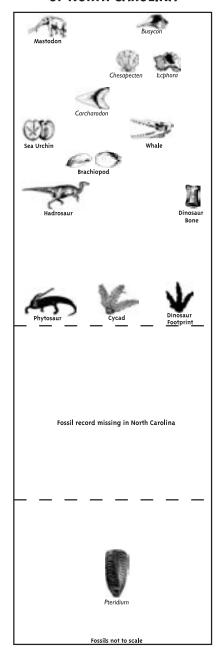




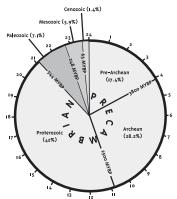
### IMPORTANT GEOLOGIC EVENTS IN NORTH CAROLINA



### IMPORTANT FOSSILS OF NORTH CAROLINA

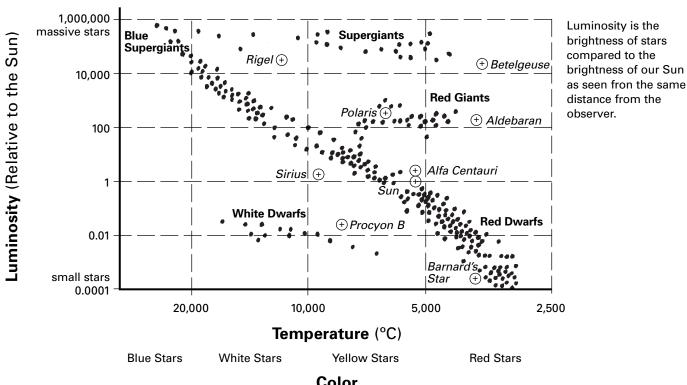


### GEOLOGIC TIME REPRESENTED BY A 24-HOUR CLOCK



### **LUMINOSITY AND TEMPERATURE OF STARS**

(Name in italics refers to star shown by a (+))



### Color

### **SOLAR SYSTEM DATA**

OBJECT	MEAN DISTANCE FROM SUN (millions of km)	OF REVOLUTION	PERIOD OF ROTATION	OF ORBIT	EQUATORIAL DIAMETER (km)	MASS (Earth=1)	DENSITY (g/cm3)	NUMBER OF MOONS
SUN			27 days	_	1,392,000	333,000.00	1.4	_
MERCURY	57.9	88 days	59 days	0.206	4,880	0.0553	5.4	0
VENUS	108.2	224.7 days	243 days	0.007	12,104	0.815	5.2	0
EARTH	149.6	365.26 days	23 hr 56 min 4 sec	0.017 56 min 4 sec	12,756	1.00	5.5	1
MARS	227.9	687 days	24 hr 37 min 23 sec	0.093 6,787 37 min 23 sec		0.1074	3.9	2
JUPITER	778.3	11.86 years	9 hr 50 min 30 sec	0.048 50 min 30 sec	142,800	317.896	1.3	39
SATURN	1,427	29.46 years	10 hr 14 min	0.056 14 min	120,000	95.185	0.7	30
URANUS	2,869	84.0 years	17 hr 14 min	0.047 14 min	51,800	14.537	1.2	21
NEPTUNE	4,496	164.8 years	16 hr	0.009	49,500	17.151	1.7	8
PLUTO	5,900	247.7 years	6 days 9 hr	0.250	2,300	0.0025	2.0	1
EARTH'S MOON	149.6 (.0386 from earth)	27.3 days	27 days 8 hr	0.055	3,476	0.0123	3.3	_

### **TOPOGRAPHIC MAP SYMBOLS**

(A more complete chart may be obtained from the US Geological Survey.)

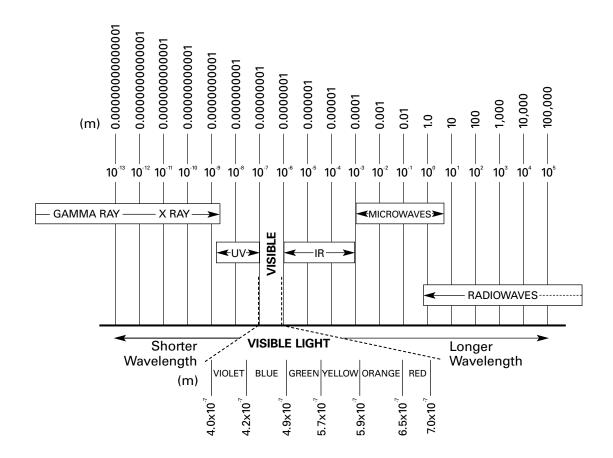
Elevation markers BMA △3938△3938 BMx945 x890	RELIEF AND SURFACE (PRINTED BROWN)								
	Index contour								
BOUNDARIES	Intermediate contour								
National — — — —	Supplementary contour								
State — — — —	Depression contours								
County, parish, municipal — — —	Levee/ <u>Levee</u> /								
Civil township, precinct, town, barrio — — —	Sand area (Sand)								
Incorporated city, village, town, hamlet —									
Reservation, national or state park — · —	WATER (PRINTED BLUE)								
Small park, cemetery, airport, etc.	Water elevation 870								
	Depth curve								
ROADS AND RELATED FEATURES	Perennial streams - river								
Hard surface, heavy duty road (RED)	Intermittent streams								
Hard surfface, mudium duty road (RED)	Intermittent river								
Improved light duty road	Perennial lake: Intermittent lake								
Unimproved dirt road –Trail ———— ======	Canal, flume, aquaduct								
Dual highway	Water well – Spring o g								
Road under construction $====================================$	Disappearing stream ————								
Railroad: single track – multiple track + + + + + + + + + + + + + + + + + + +	Small rapids ————								
Bridge: road	Small falls ———								
Drawbridge: road	Large rapids								
Tunnel: road	Large falls								
	Small masonry or earth dam								
BUILDINGS AND RELATED FEATURES									
Building	Dam with lock								
School – Church – Cemeteries † †									
Power transmission line	Canal with lock								
Wells other than water (labeled as to type) ○ 🛣									
Tanks; oil, water, etc. (labeled as to type)	Marsh (swamp)								
Located or landmark object – Windmill   ⊙	Submerged marsh or swamp								
Campground; picnic area	Wooded marsh or swamp								
Open pit, mine, or quarry – Prospect	Foreshore flat								
Shaft –Tunnel entrance —	Rock or coral reef								
	Rock, bare or awash *								
VEGETATION (PRINTED GREEN)	Glacier or permanent snowfield								
Woods									
Scrub									

### **EQUATIONS**

**%Error=** 
$$\frac{Difference\ from\ accepted\ value}{accepted\ value}$$
 X 100

**Density=** 
$$\frac{mass}{volume}$$

### **ELECTROMAGNETIC SPECTRUM**



### **DEWPOINT TEMPERATURES**

Dry-Bulb			Diffe	erenc	e Be	twee	n We	t-Bul	b an	d Dry	y-Bul∣	b Ten	npera	ture	s (C°)	
Temperature (C°)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
-20	-20	-33														
-18	-18	-28														
-16	-16	-24														
-14	-14	-21	-36													
-12	-12	-18	-28													
-10	-10	-14	-22													
-8	-8	-12	-18	-29												
-6	-6	-10	-14	-22												
-4	-4	-7	-12	-17	-29											
-2	-2	-5	-8	-13	-20											
0	0	-3	-6	9	-15	-24										
2	2	-1	-3	-6	-11	-17										
4	4	1	-1	-4	-7	-11	-19									
6	6	4	1	-1	-4	-7	-13	-21								
8	8	6	3	1	-2	-5	-9	-14								
10	10	8	6	4	1	-2	-5	-9	-14	-28						
12	12	10	8	6	4	1	-2	-5	-9	-16						
14	14	12	11	9	6	4	1	-2	-5	-10	-17					
16	16	14	13	11	9	7	4	1	-1	-6	-10	-17				
18	18	16	15	13	11	9	7	4	2	-2	-5	-10	-19			
20	20	19	17	15	14	12	10	7	4	2	-2	-5	-10	-19		
22	22	21	19	17	16	14	12	10	8	5	3	-1	-5	-10	-19	
24	24	23	21	20	18	16	14	12	10	8	6	2	-1	-5	-10	-18
26	26	25	23	22	20	18	17	15	13	11	9	6	3	0	-4	-9
28	28	27	25	24	22	21	19	17	16	14	11	9	7	4	1	-3
30	30	29	27	26	24	23	21	19	18	16	14	12	10	8	5	1

### **RELATIVE HUMIDITY** (%)

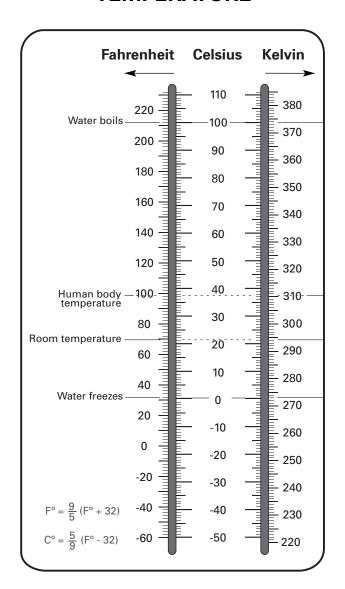
Dry-Bulb			Diffe	erenc	e Be	twee	n We	t-Bul	b an	d Dry	/-Bull	b Ten	npera	ture	s (C°)	
Temperature (C°)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
-20	100	28														
-18	100	40														
-16	100	48	0													
-14	100	55	11													
-12	100	61	23													
-10	100	66	33	0												
-8	100	71	41	13												
-6	100	73	48	20	0											
-4	100	77	54	32	11											
-2	100	79	58	37	20	1										
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10	0							
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6	0		
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5	0	
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	0
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	25	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

### LAPSE RATE

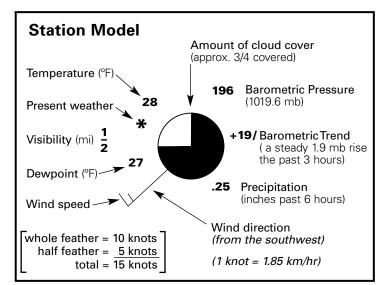
### 

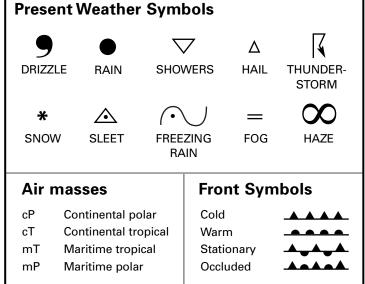
Temperature (C°)

### **TEMPERATURE**

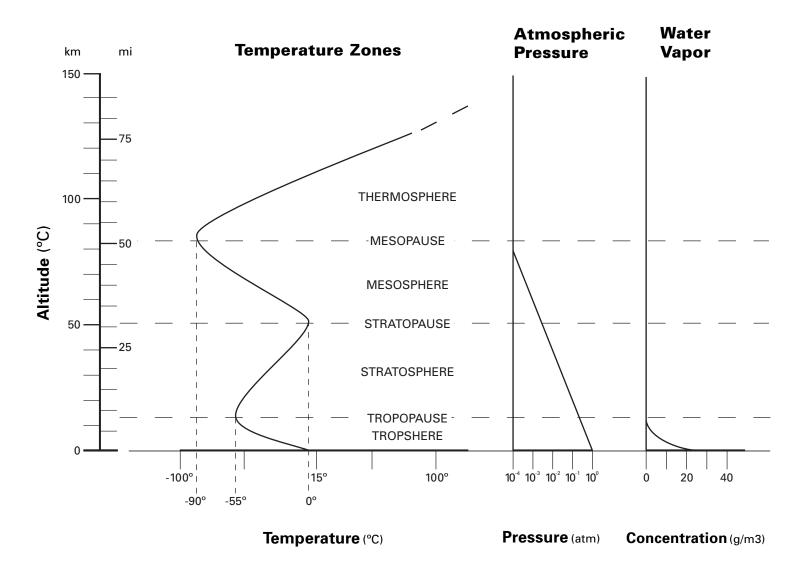


### WEATHER MAP INFORMATION

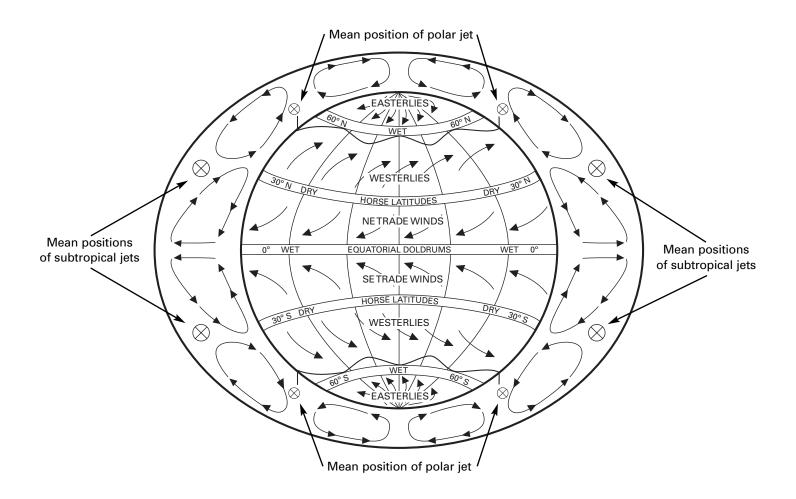




### **SELECTED PROPERTIES OF EARTH'S ATMOSPHERE**

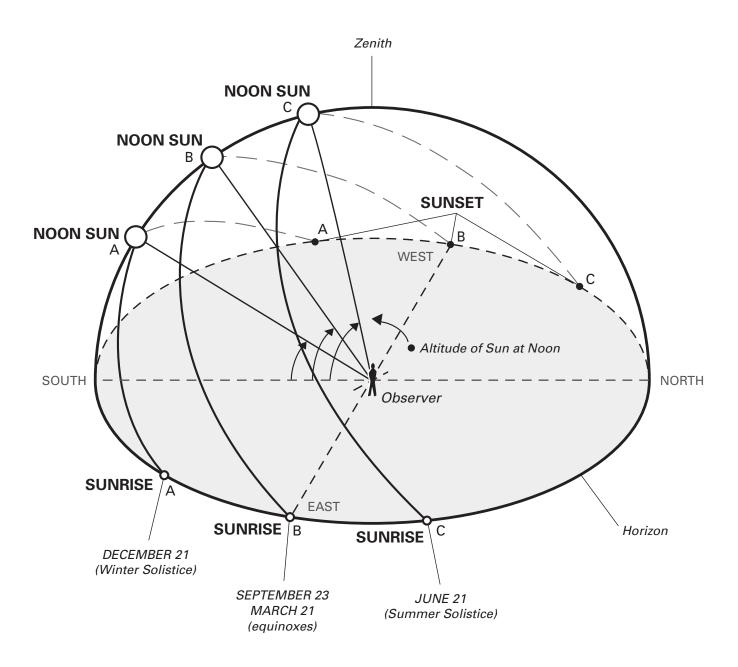


### PLANETARY WIND AND MOISTURE BELTS IN THE TROPOSPHERE

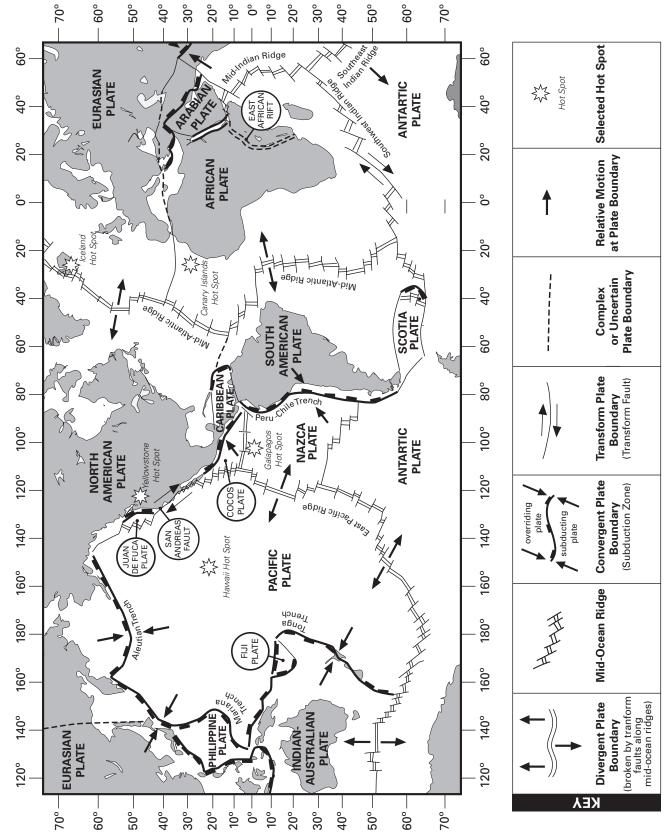


The drawing shows the locations of the belts near the time of an equinox. The locations shift somewhat with the changing latitude of the Sun's vertical ray. In the Northern Hemisphere the belts shift northward in summer and southward in winter.

### APPARENT PATHS OF SUN AT 36° N. LATITUDE



### **TECTONIC PLATES**



NOTE: Not all plates and boundaries are shown.